

Claims:

- Sub A*
1. An expandable medical device comprising:
a plurality of elongated beams, the plurality of elongated beams joined
together to form a substantially cylindrical device which is expandable from a
cylinder having a first diameter to a cylinder having a second diameter, the
plurality of the elongated beams having a beam width in a circumferential
direction;
a plurality of hinges connecting the elongated beams having a hinge width,
wherein the hinge width is smaller than the beam width;
a pawl disposed adjacent to and substantially parallel to the hinge prior to
expansion of the medical device;
a plurality of teeth adapted to receive the pawl.
- Sub B*
2. The expandable medical device according to Claim 1, wherein
during expansion the hinges experience deformation below their elastic limit.
3. The expandable medical device according to Claim 2, wherein
deformation during expansion is confined to the hinge.
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4. The expandable medical device according to Claim 1, wherein
during expansion, the pawl experiences at least two degrees of freedom of motion.
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5. The expandable medical device according to Claim 4, wherein a
distal tip of the pawl engages at least one of the plurality of teeth thereby retaining
a generally cylindrical expanded second diameter.
6. The expandable medical device according to Claim 1, wherein a
recoil of the medical device after expansion is less than about eight percent.

7. The expandable medical device according to Claim 1, wherein the device is manufactured of one of the materials selected from the group consisting of: polymers, Nitinol, martensitic Nitinol, superelastic Nitinol.

5 8. The expandable medical device according to Claim 7, wherein a recoil of the medical device after expansion is less than about eight percent.

10 9. The expandable medical device according to Claim 8, wherein a recoil of the medical device after expansion is less than about five percent.

10 10. The expandable medical device according to Claim 1, wherein the device is manufactured of a biodegradable material.

15 11. The expandable medical device according to Claim 10, wherein a recoil of the expandable device after expansion is less than about eight percent.

12. The expandable medical device according to Claim 1, wherein the device is manufactured of a composite of polymer and Nitinol.

20 13. The expandable medical device according to Claim 12, wherein a recoil of the expandable device after expansion is less than about eight percent.

14. The expandable medical device according to Claim 13, wherein the Nitinol is martensitic Nitinol.

25 15. The expandable medical device according to Claim 1, wherein the device is manufactured from a continuous cylindrical body.

30 16. The expandable medical device according to Claim 1, wherein the device is laser-cut.

Sub A2
C 17. The expandable medical device according to Claim 7, wherein the elongated beams further includes a plurality of apertures disposed therethrough, and a beneficial agent is disposed within the apertures.

Sub C
18. The expandable medical device according to Claim 14, wherein the polymer further includes a beneficial agent which is released from the polymer after insertion of the expandable medical device.

10 19. The expandable medical device according to Claim 10, wherein the biodegradable material further includes a beneficial agent which is released from the biodegradable material after insertion of the expandable medical device.

Sub A3
C 20. The expandable medical device according to Claim 1, wherein the elongated beams further includes a plurality of apertures disposed therethrough, and a beneficial agent is disposed within the apertures.

Sub C
21. The expandable medical device according to Claim 7, wherein the expandable medical device is formed in a semi-expanded state.

20 22. The expandable medical device according to Claim 21, wherein the expandable medical device is further configured to be retracted to a diameter less than the first diameter.

25 23. An expandable medical device comprising:
a cylindrical tube;
a plurality of axial slots formed in the cylindrical tube in an arrangement to define a network of elongated struts, wherein each of the elongated struts are radially displaced from adjacent struts, and each elongated strut further includes at least one tooth disposed thereupon;

a pawl formed between the elongated struts, having a distal end adapted to be received by the tooth; and

5 a plurality of hinges formed between the elongated struts, the hinges allowing the cylindrical tube to be expanded from a first diameter to a second diameter by bending of the hinges and engaging the distal end of the pawl with the tooth.

24. The expandable medical device according to Claim 23, wherein a deformation of the hinge is below its elastic limit.

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25. The expandable medical device according to Claim 23, wherein the bending of the pawl is controlled by the geometry of the hinge.

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26. The expandable medical device according to Claim 24, wherein prior to expansion the distal tip of the pawl exhibits one degree of freedom, and develops a second degree of freedom along the axis of the pawl as sufficient bend angle is attained in the hinge.

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27. An expandable medical device comprising:
a cylindrical expandable body of Nitinol; and
a locking feature for locking the expanded body in an expanded position,
wherein the locking mechanism prevents recoil of the expanded body of greater than 6 percent.

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28. The expandable medical device according to Claim 27, wherein the locking feature includes a pawl disposed on one end of an elongated member and a plurality of teeth disposed on another adjacent elongated member and the pawl engages a tooth on the other elongated member when the expandable device is in an expanded position.

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29. The expandable medical device according to Claim 27, wherein the expandable medical device is constructed from a cylindrical body.

30. The expandable medical device according to Claim 27, wherein the recoil is less than 4 percent.

31. The expandable medical device according to Claim 27, further including a hinge, wherein the hinge undergoes deformation below its elastic limit as the expandable device is expanded.

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32. A method of processing an expandable medical device, the method comprising:

fabricating a cylindrical expandable medical device from martensitic Nitinol, wherein the expandable device has a first unexpanded diameter;

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expanding the cylindrical expandable medical device to an expanded second diameter, wherein deformation during expansion is confined to a hinge and the deformation is below the elastic limit of the material;

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processing the expandable medical device; and

restoring the expandable medical device to the unexpanded first diameter by applying heat to the expandable medical device.

33. The method according to Claim 32, wherein the fabricating comprises cutting the expandable medical device from a continuous cylinder with a laser.

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34. The method according to Claim 32, wherein the processing comprises electropolishing.

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35. The method according to Claim 32, wherein the processing comprises coating.

36. The method according to Claim 32, wherein the processing comprises polishing.

5 37. An expandable medical device comprising:
a plurality of elongated beams, the plurality of elongated beams joined together to form a substantially cylindrical device which is expandable to form a cylinder having a first diameter to a cylinder having a second diameter, the plurality of the elongated beams having a beam width in a circumferential 10 direction;

a plurality of hinges having a hinge width, wherein the hinge width is smaller than the beam width; and
an internal self locking mechanism.

15 38. The expandable medical device according to Claim 37, wherein the internal self-locking mechanism comprises a pawl and a plurality of teeth adapted to receive the pawl.

20 39. A method of constructing an expandable medical device, the method comprising:

fabricating an expandable medical device from a cylindrical member, wherein the expandable device is formed having a first unexpanded diameter;
retracting the expandable medical device to an unexpanded second diameter, wherein deformation during retraction is confined to a hinge portion of 25 the expandable medical device; and

retaining the expandable medical device in said unexpanded second diameter.

30 40. The method according to Claim 39, wherein the cylindrical member is formed of superelastic Nitinol alloy.

41. The method according to Claim 40, wherein the step of retaining the expandable medical device includes disposing a retaining means about the unexpanded second diameter of the expandable medical device.

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42. The method according to Claim 41, further including the steps of:
disposing the retracted expandable medical device onto a delivery device;
placing the delivery device within an artery of a patient; and
removing said retaining means wherein the expandable medical device
returns to said first unexpanded diameter.

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43. The method according to Claim 42, further including the step of
expanding the expandable medical device to an expanded diameter larger than the
first unexpanded diameter wherein a locking means is engaged to retain the
expandable medical device in said first expanded diameter.

Add A4

7 add B'